



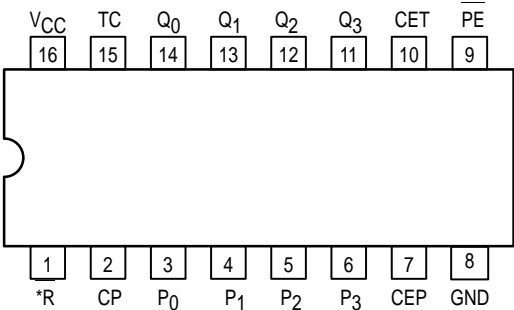
MC74AC160
MC74ACT160
MC74AC162
MC74ACT162

SYNCHRONOUS
 PRESETTABLE
 BCD DECADE COUNTER

**Synchronous Presettable
BCD Decade Counter**

The MC74AC160/74ACT160 and MC74AC162/74ACT162 are high-speed synchronous decade counters operating in the BCD (8421) sequence. They are synchronously presettable for application in programmable dividers and have two types of Count Enable inputs plus a Terminal Count output for versatility in forming synchronous multistage counters. The MC74AC160/74ACT160 has an asynchronous Master Reset input that overrides all other inputs and forces the outputs LOW. The MC74AC162/74ACT162 has a Synchronous Reset input that overrides counting and parallel loading and allows all outputs to be simultaneously reset on the rising edge of the clock.

- Synchronous Counting and Loading
- High-Speed Synchronous Expansion
- Typical Count Rate of 120 MHz
- Outputs Source/Sink 24 mA
- 'ACT160 and 'ACT162 Have TTL Compatible Inputs



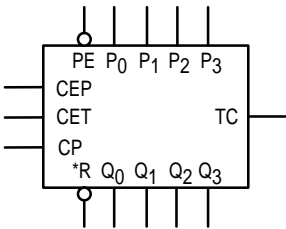
PIN NAMES

| | |
|--------------------------------|--|
| CEP | Count Enable Parallel Input |
| CET | Count Enable Trickle Input |
| CP | Clock Pulse Input |
| MR | ('160) Asynchronous Master Reset Input |
| SR | ('162) Synchronous Reset Input |
| P ₀ –P ₃ | Parallel Data Inputs |
| PE | Parallel Enable Input |
| Q ₀ –Q ₃ | Flip-Flop Outputs |
| TC | Terminal Count Output |

**N SUFFIX
CASE 648-08
PLASTIC**

**D SUFFIX
CASE 751B-05
PLASTIC**

LOGIC SYMBOL



*MR for '160
 *SR for '162

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

FUNCTIONAL DESCRIPTION

The MC74AC160/74ACT160 and MC74AC162/74ACT162 count modulo-10 in the BCD (8421) sequence. From state 9 (HLLH) they increment to state 0 (LLLL). The clock inputs of all flip-flops are driven in parallel through a clock buffer. Thus all changes of the Q outputs (except due to Master Reset of the '160) occur as a result of, and synchronous with, the LOW-to-HIGH transition of the CP input signal. The circuits have four fundamental modes of operation, in order of precedence: asynchronous reset ('160), synchronous reset ('162), parallel load, count-up and hold. Five control inputs — Master Reset (MR, '160), Synchronous Reset (SR, '162), Parallel Enable (PE), Count Enable Parallel (CEP) and Count Enable Trickle (CET) — determine the mode of operation, as shown in the Mode Select Table. A LOW signal on MR overrides all other inputs and asynchronously forces all outputs LOW. A LOW signal on SR overrides counting and parallel loading and allows all outputs to go LOW on the next rising edge of CP. A LOW signal on PE overrides counting and allows information on the Parallel Data (P_n) inputs to be loaded into the flip-flops on the next rising edge of CP. With PE and MR ('160) or SR ('162) HIGH, CEP and CET permit counting when both are HIGH. Conversely, a LOW signal on either CEP or CET inhibits counting.

The MC74AC160/74ACT160 and MC74AC162/74ACT162 use D-type edge-triggered flip-flops and changing the SR, PE, CEP and CET inputs when the CP is in either state does not cause errors, provided that the recommended setup and hold times, with respect to the rising edge of CP, are observed.

The Terminal Count (TC) output is HIGH when CET is HIGH and counter is in state 9. To implement synchronous multistage counters, the TC outputs can be used with the CEP and CET inputs in two different ways. Please refer to the MC74AC568 data sheet. The TC output is subject to decoding spikes due to internal race conditions and is therefore not recommended for use as a clock or asynchronous reset for flip-flops, counters or registers. In the MC74AC160/74ACT160 and MC74AC162/74ACT162 decade counters, the TC output is fully decoded and can only be HIGH in state 9. If a decade counter is preset to an illegal state, or assumes an illegal state when power is applied, it will return to the normal sequence within two counts, as shown in the State Diagram.

Logic Equations: Count Enable \equiv CEP • CET • PE
 TC = Q₀ • Q₁ • Q₂ • Q₃ • CET

MODE SELECT TABLE

| *SR | PE | CET | CEP | Action on the Rising Clock Edge (┐) |
|-----|----|-----|-----|---|
| L | X | X | X | Reset (Clear) |
| H | L | X | X | Load (P _n → Q _n) |
| H | H | H | H | Count (Increment) |
| H | H | L | X | No Change (Hold) |
| H | H | X | L | No Change (Hold) |

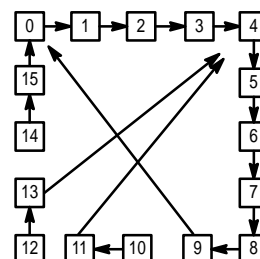
*For '162 only

H = HIGH Voltage Level

L = LOW Voltage Level

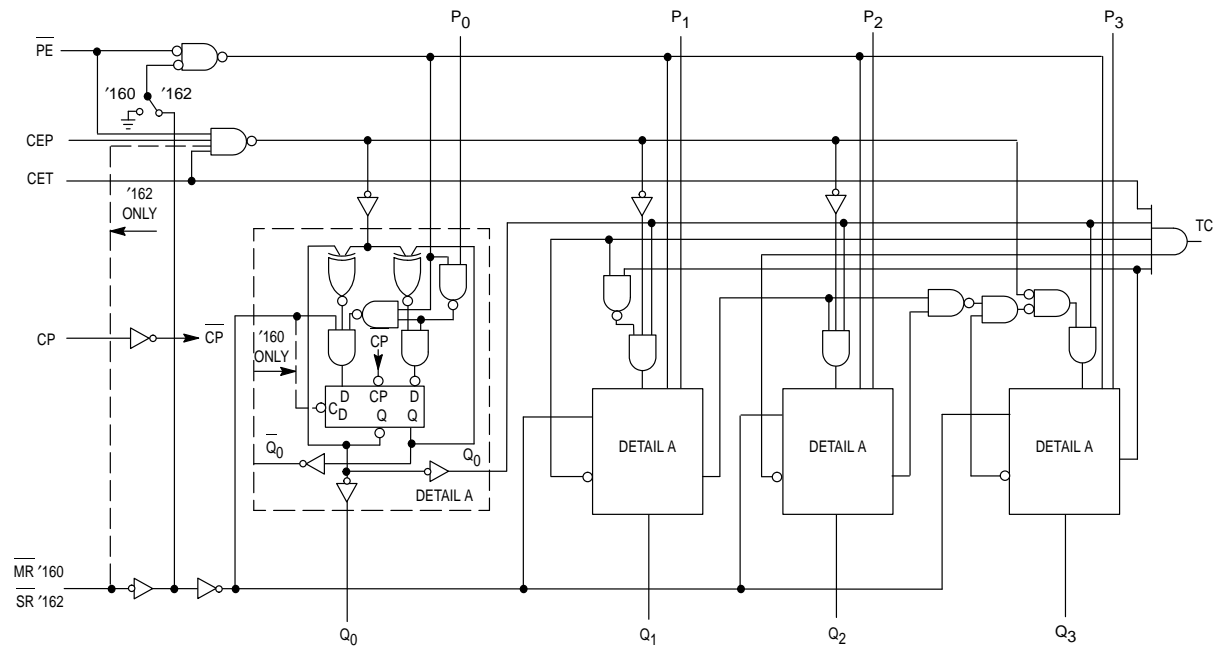
X = Immaterial

STATE DIAGRAM



MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

MAXIMUM RATINGS*

| Symbol | Parameter | Value | Unit |
|-----------|---|------------------------|------|
| V_{CC} | DC Supply Voltage (Referenced to GND) | -0.5 to +7.0 | V |
| V_{in} | DC Input Voltage (Referenced to GND) | -0.5 to $V_{CC} + 0.5$ | V |
| V_{out} | DC Output Voltage (Referenced to GND) | -0.5 to $V_{CC} + 0.5$ | V |
| I_{in} | DC Input Current, per Pin | ± 20 | mA |
| I_{out} | DC Output Sink/Source Current, per Pin | ± 50 | mA |
| I_{CC} | DC V_{CC} or GND Current per Output Pin | ± 50 | mA |
| T_{stg} | Storage Temperature | -65 to +150 | °C |

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Unit |
|-------------------|---|------------------|-----|----------|------|
| V_{CC} | Supply Voltage | 'AC | 2.0 | 5.0 | V |
| | | 'ACT | 4.5 | 5.0 | |
| V_{in}, V_{out} | DC Input Voltage, Output Voltage (Ref. to GND) | 0 | | V_{CC} | V |
| t_r, t_f | Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs | V_{CC} @ 3.0 V | 150 | | ns/V |
| | | V_{CC} @ 4.5 V | 40 | | |
| | | V_{CC} @ 5.5 V | 25 | | |
| t_r, t_f | Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs | V_{CC} @ 4.5 V | 10 | | ns/V |
| | | V_{CC} @ 5.5 V | 8.0 | | |
| T_J | Junction Temperature (PDIP) | | | 140 | °C |
| T_A | Operating Ambient Temperature Range | −40 | 25 | 85 | °C |
| I_{OH} | Output Current — High | | | −24 | mA |
| I_{OL} | Output Current — Low | | | 24 | mA |

1. V_{in} from 30% to 70% V_{CC} ; see individual Data Sheets for devices that differ from the typical input rise and fall times.

2. V_{in} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74AC | | 74AC | Unit | Conditions |
|------------------|-----------------------------------|------------------------|------------------------|-------------------|------------------------------------|------|---|
| | | | T _A = +25°C | | T _A = −40°C to +85°C | | |
| | | | Typ | Guaranteed Limits | | | |
| V _{IH} | Minimum High Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | V | V _{OUT} = 0.1 V or V _{CC} − 0.1 V |
| | | 4.5 | 2.25 | 3.15 | 3.15 | | |
| | | 5.5 | 2.75 | 3.85 | 3.85 | | |
| V _{IL} | Maximum Low Level Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | V | V _{OUT} = 0.1 V or V _{CC} − 0.1 V |
| | | 4.5 | 2.25 | 1.35 | 1.35 | | |
| | | 5.5 | 2.75 | 1.65 | 1.65 | | |
| V _{OH} | Minimum High Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | V | I _{OUT} = −50 μA |
| | | 4.5 | 4.49 | 4.4 | 4.4 | | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | |
| | | 3.0 | | 2.56 | 2.46 | V | *V _{IN} = V _{IL} or V _{IH} −12 mA I _{OH} −24 mA −24 mA |
| | | 4.5 | | 3.86 | 3.76 | | |
| | | 5.5 | | 4.86 | 4.76 | | |
| V _{OL} | Maximum Low Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | V | I _{OUT} = 50 μA |
| | | 4.5 | 0.001 | 0.1 | 0.1 | | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | |
| | | 3.0 | | 0.36 | 0.44 | V | *V _{IN} = V _{IL} or V _{IH} 12 mA I _{OL} 24 mA 24 mA |
| | | 4.5 | | 0.36 | 0.44 | | |
| | | 5.5 | | 0.36 | 0.44 | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | | | 75 | mA | V _{OLD} = 1.65 V Max |
| I _{OHD} | | 5.5 | | | −75 | mA | V _{OHD} = 3.85 V Min |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 8.0 | 80 | μA | V _{IN} = V _{CC} or GND |

* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

Note: I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC} .

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74AC160

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74AC160 | | 74AC160 | | Unit | Fig. No. |
|------------------|---|--------------------------|--|--------------|--|--------------|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Max | Min | Max | | |
| f _{max} | Maximum Count Frequency | 3.3 5.0 | 65 110 | — — | 60 95 | — — | MHz | 3-3 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input HIGH) | 3.3 5.0 | 2.0 1.5 | 12.0 9.0 | 1.5 1.0 | 14.0 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input HIGH) | 3.3 5.0 | 2.0 1.5 | 12.0 9.0 | 1.5 1.5 | 14.0 10.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input LOW) | 3.3 5.0 | 2.0 1.5 | 12.0 9.0 | 1.5 1.0 | 14.0 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input LOW) | 3.3 5.0 | 2.0 1.5 | 12.0 9.0 | 1.5 1.5 | 14.0 10.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to TC | 3.3 5.0 | 3.0 2.0 | 15.0 11.0 | 2.5 1.5 | 17.5 12.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to TC | 3.3 5.0 | 3.5 2.0 | 14.5 11.0 | 2.5 2.0 | 16.5 12.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CET to TC | 3.3 5.0 | 2.0 1.5 | 10.5 7.5 | 1.5 1.0 | 12.5 9.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay CET to TC | 3.3 5.0 | 2.5 2.0 | 11.5 9.0 | 2.0 1.5 | 13.5 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay MR to Q _n ('AC160) | 3.3 5.0 | 2.0 1.5 | 12.0 9.5 | 1.5 1.0 | 13.5 10.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay MR to TC | 3.3 5.0 | 3.5 2.5 | 15.0 12.0 | 3.0 2.0 | 17.0 13.5 | ns | 3-6 |

* Voltage Range 3.3 V is 3.3 V ±0.3 V.
Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74AC162

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74AC162 | | | 74AC162 | | Unit | Fig. No. |
|------------------|---|--------------------------|--|-----|--------------|--|--------------|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = −40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Count Frequency | 3.3 5.0 | 80 125 | | | 60 100 | | MHz | 3-3 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input HIGH) | 3.3 5.0 | 2.0 2.0 | | 12.0 9.0 | 1.5 1.5 | 13.5 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input HIGH) | 3.3 5.0 | 2.0 2.0 | | 12.0 9.0 | 1.5 1.5 | 13.5 10.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input LOW) | 3.3 5.0 | 2.0 2.0 | | 12.0 9.0 | 1.5 1.5 | 13.5 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input LOW) | 3.3 5.0 | 2.0 2.0 | | 12.0 9.0 | 1.5 1.5 | 13.5 10.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to TC | 3.3 5.0 | 2.0 2.0 | | 15.0 11.0 | 1.5 1.5 | 17.0 13.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to TC | 3.3 5.0 | 2.0 2.0 | | 14.0 11.0 | 1.5 1.5 | 16.0 13.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CET to TC | 3.3 5.0 | 2.0 2.0 | | 10.0 7.0 | 1.5 1.5 | 11.5 8.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CET to TC | 3.3 5.0 | 2.0 2.0 | | 11.0 8.0 | 1.5 1.5 | 12.5 9.5 | ns | 3-6 |

*Voltage Range 3.3 V is 3.0 V ±0.3 V.

Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74AC160

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74AC160 | 74AC160 | Unit | Fig. No. |
|------------------|---|--------------------------|--|--|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | T _A = −40°C to +85°C C _L = 50 pF | | |
| | | | Guaranteed Maximum | | | |
| t _s | Setup Time, HIGH or LOW P _n to CP | 3.3 5.0 | 13.5 8.5 | 16.0 10.5 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW P _n to CP | 3.3 5.0 | −1.0 0 | − 0.5 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW PE or SR to CP | 3.3 5.0 | 11.5 7.5 | 14.0 8.5 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW PE or SR to CP | 3.3 5.0 | 0 0.5 | 0 1.0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW CEP or CET to CP | 3.3 5.0 | 6.0 4.5 | 7.0 5.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW CEP or CET to CP | 3.3 5.0 | 0 0 | 0 0.5 | ns | 3-9 |
| t _w | Clock Pulse Width (Load) HIGH or LOW | 3.3 5.0 | 4.0 3.0 | 5.0 3.5 | ns | 3-6 |
| t _w | Clock Pulse Width (Count) HIGH or LOW | 3.3 5.0 | 7.0 4.5 | 7.5 5.5 | ns | 3-6 |
| t _w | MR Pulse Width, LOW (‘AC160) | 3.3 5.0 | 5.5 4.5 | 7.5 6.0 | ns | 3-6 |
| t _{rec} | Recovery Time MR to CP (‘AC160) | 3.3 5.0 | − 0.5 0 | 0 0.5 | ns | 3-9 |

* Voltage Range 3.3 V is 3.3 V ±0.3 V.

Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74AC162

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74AC162 | | 74AC162 | Unit | Fig. No. |
|----------------|---|--------------------------|--|------------|--|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = −40°C to +85°C C _L = 50 pF | | |
| | | | Typ | Guaranteed | Minimum | | |
| t _s | Setup Time, HIGH or LOW P _n to CP | 3.3 | | 8.0 | 9.0 | ns | 3-9 |
| | | 5.0 | | 5.0 | 6.0 | | |
| t _h | Hold Time, HIGH or LOW P _n to CP | 3.3 | | 0.5 | 1.0 | ns | 3-9 |
| | | 5.0 | | 0.5 | 1.0 | | |
| t _s | Setup Time, HIGH or LOW PE to CP | 3.3 | | 10.0 | 11.0 | ns | 3-9 |
| | | 3.3 | | 6.0 | 7.0 | | |
| t _h | Hold Time, HIGH or LOW PE to CP | 3.3 | | 0.5 | 1.0 | ns | 3-9 |
| | | 5.0 | | 0.5 | 1.0 | | |
| t _s | Setup Time, HIGH or LOW CEP or CET to CP | 3.3 | | 6.0 | 7.0 | ns | 3-9 |
| | | 5.0 | | 4.0 | 5.0 | | |
| t _h | Hold Time, HIGH or LOW CEP or CET to CP | 3.3 | | 0.5 | 1.0 | ns | 3-9 |
| | | 5.0 | | 0.5 | 1.0 | | |
| t _s | Setup Time, HIGH or LOW SR to CP | 3.3 | | 8.0 | 9.0 | ns | 3-9 |
| | | 5.0 | | 6.0 | 7.0 | | |
| t _h | Hold Time, HIGH or LOW SR to CP | 3.3 | | 0.5 | 1.0 | ns | 3-9 |
| | | 5.0 | | 0.5 | 1.0 | | |
| t _w | Clock Pulse Width (Load) HIGH or LOW | 3.3 | | 5.5 | 6.0 | ns | 3-6 |
| | | 5.0 | | 4.5 | 5.0 | | |
| t _w | Clock Pulse Width (Count) HIGH or LOW | 3.3 | | 5.0 | 5.5 | ns | 3-6 |
| | | 5.0 | | 4.0 | 4.5 | | |

*Voltage Range 3.3 V is 3.3 V ± 0.3 V.

Voltage Range 5.0 V is 5.0 V ± 0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74ACT | | 74ACT | Unit | Conditions |
|-------------------|--|------------------------|------------------------|-------------------|------------------------------------|------|---|
| | | | T _A = +25°C | | T _A = –40°C to +85°C | | |
| | | | Typ | Guaranteed Limits | | | |
| V _{IH} | Minimum High Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1 V or V _{CC} – 0.1 V |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | |
| V _{IL} | Maximum Low Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1 V or V _{CC} – 0.1 V |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | |
| V _{OH} | Minimum High Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = –50 μA |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | |
| | | 4.5 | | 3.86 | 3.76 | V | *V _{IN} = V _{IL} or V _{IH} –24 mA I _{OH} –24 mA |
| | | 5.5 | | 4.86 | 4.76 | | |
| V _{OL} | Maximum Low Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | |
| | | 4.5 | | 0.36 | 0.44 | V | *V _{IN} = V _{IL} or V _{IH} 24 mA I _{OL} 24 mA |
| | | 5.5 | | 0.36 | 0.44 | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND |
| ΔI _{CCT} | Additional Max. I _{CC} /Input | 5.5 | 0.6 | | 1.5 | mA | V _I = V _{CC} – 2.1 V |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | | | 75 | mA | V _{OLD} = 1.65 V Max |
| I _{OHD} | | 5.5 | | | –75 | mA | V _{OHD} = 3.85 V Min |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 8.0 | 80 | μA | V _{IN} = V _{CC} or GND |

* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74ACT160

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74ACT160 | | | 74ACT160 | | Unit | Fig. No. |
|------------------|---|--------------------------|--|-----|------|--|------|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = −40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Count Frequency | 5.0 | 120 | | | 100 | | MHz | 3-3 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input HIGH) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input HIGH) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input LOW) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input LOW) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to TC | 5.0 | 2.0 | 8.0 | 12.0 | 2.0 | 14.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to TC | 5.0 | 2.0 | 8.0 | 12.0 | 2.0 | 14.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CET to TC | 5.0 | 2.0 | 6.0 | 8.5 | 2.0 | 9.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CET to TC | 5.0 | 2.0 | 7.0 | 9.5 | 2.0 | 11.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay MR to Q _n ('AC160) | 5.0 | 1.5 | 6.0 | 9.5 | 1.5 | 11.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay MR to TC | 5.0 | 2.5 | — | 13.0 | 2.5 | 14.0 | ns | 3-6 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74ACT162

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74ACT162 | | | 74ACT162 | | Unit | Fig. No. |
|------------------|---|--------------------------|--|-----|------|--|------|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Count Frequency | 5.0 | 120 | | | 100 | | MHz | 3-3 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input HIGH) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input HIGH) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to Q _n (PE Input LOW) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to Q _n (PE Input LOW) | 5.0 | 2.0 | 6.0 | 10.0 | 2.0 | 11.0 | ns | 3-6 |
| t _{PLH} | Propagation Delay CP to TC | 5.0 | 2.0 | 8.0 | 13.0 | 2.0 | 14.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CP to TC | 5.0 | 2.0 | 8.0 | 13.0 | 2.0 | 14.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay CET to TC | 5.0 | 2.0 | 6.0 | 9.0 | 2.0 | 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay CET to TC | 5.0 | 2.0 | 6.0 | 9.0 | 2.0 | 10.5 | ns | 3-6 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V. 3

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74ACT160

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74ACT160 | | 74ACT160 | Unit | Fig. No. |
|------------------|---|--------------------------|--|--------------------|--|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = −40°C to +85°C C _L = 50 pF | | |
| | | | Typ | Guaranteed Maximum | | | |
| t _s | Setup Time, HIGH or LOW P _n to CP | 5.0 | 4.0 | 6.5 | 8.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW P _n to CP | 5.0 | −4.0 | −0.5 | 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW PE or MR to CP | 5.0 | 4.0 | 8.5 | 10.5 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW PE or MR to CP | 5.0 | −4.0 | 0 | 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW CEP or CET to CP | 5.0 | 3.0 | 6.0 | 7.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW CEP or CET to CP | 5.0 | −3.0 | 0 | 0 | ns | 3-9 |
| t _w | Clock Pulse Width (Load) HIGH or LOW | 5.0 | 3.0 | 4.0 | 4.0 | ns | 3-6 |
| t _w | Clock Pulse Width (Count) HIGH or LOW | 5.0 | 3.0 | 4.0 | 4.0 | ns | 3-6 |
| t _w | MR Pulse Width, LOW (‘ACT160) | 5.0 | 2.0 | 4.0 | 6.0 | ns | 3-6 |
| t _{rec} | Recovery Time MR to CP (‘ACT160) | 5.0 | −1.0 | 0 | 0 | ns | 3-9 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

MC74ACT162

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74ACT162 | | 74ACT162 | Unit | Fig. No. |
|----------------|---|--------------------------|--|--------------------|--|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = −40°C to +85°C C _L = 50 pF | | |
| | | | Typ | Guaranteed Maximum | | | |
| t _s | Setup Time, HIGH or LOW P _n to CP | 5.0 | 4.0 | 7.0 | 10.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW P _n to CP | 5.0 | −3.0 | −1.0 | 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW PE to CP | 5.0 | 4.0 | 7.0 | 10.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW PE to CP | 5.0 | −3.0 | −1.0 | 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW SR to CP | 5.0 | 5.0 | 10 | 11.5 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW SR to CP | 5.0 | −5.0 | 0 | 0 | ns | 3-9 |
| t _s | Setup Time, HIGH or LOW CET to CP | 5.0 | 3.0 | 6.0 | 7.0 | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW CET to CP | 5.0 | −3.0 | 0 | 0 | ns | 3-9 |
| t _w | Clock Pulse Width (Load) HIGH or LOW | 5.0 | 2.0 | 4.5 | 5.0 | ns | 3-6 |
| t _w | Clock Pulse Width (Count) HIGH or LOW | 5.0 | 2.0 | 4.0 | 4.5 | ns | 3-6 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

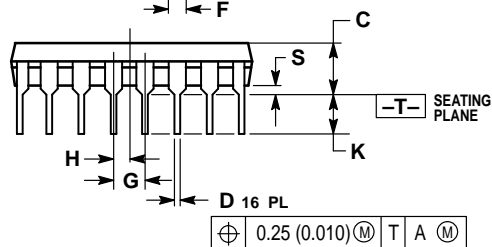
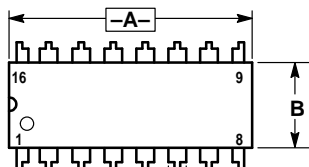
CAPACITANCE

| Symbol | Parameter | Value Typ | Unit | Test Conditions |
|-----------------|-------------------------------|-----------|------|-------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = 5.0 V |
| C _{PD} | Power Dissipation Capacitance | 45 | pF | V _{CC} = 5.0 V |

MC74AC160 MC74ACT160 MC74AC162 MC74ACT162

OUTLINE DIMENSIONS

N SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R

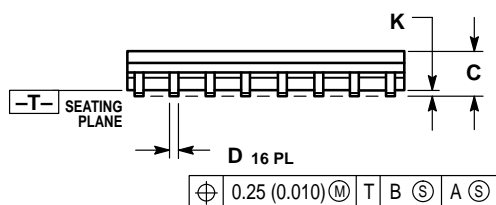
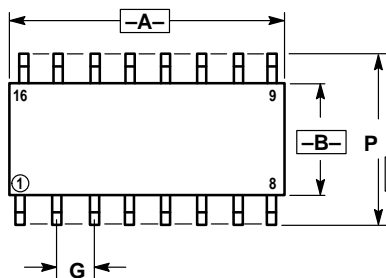


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.740 | 0.770 | 18.80 | 19.55 |
| B | 0.250 | 0.270 | 6.35 | 6.85 |
| C | 0.145 | 0.175 | 3.69 | 4.44 |
| D | 0.015 | 0.021 | 0.39 | 0.53 |
| F | 0.040 | 0.70 | 1.02 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.050 BSC | | 1.27 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.130 | 2.80 | 3.30 |
| L | 0.295 | 0.305 | 7.50 | 7.74 |
| M | 0° | 10° | 0° | 10° |
| S | 0.020 | 0.040 | 0.51 | 1.01 |


D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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MC74AC160/D

